PATENT ABSTRACTS OF JAPAN

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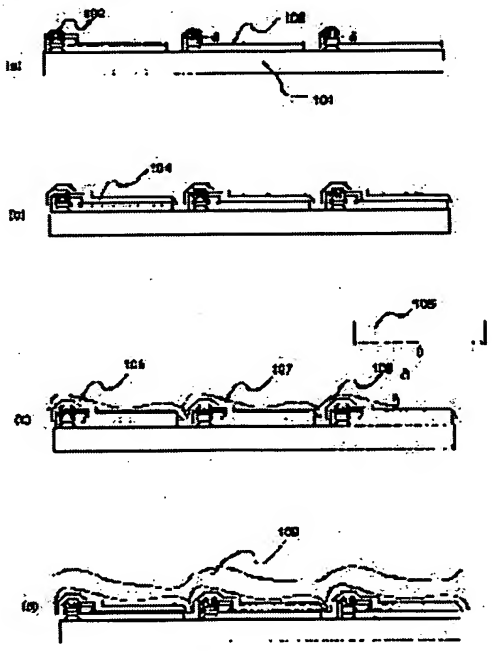
(54) MANUFACTURE OF ACTIVE MATRIX TYPE ORGANIC EL DISPLAY BODY

(57)Abstract:

PROBLEM TO BE SOLVED: To manufacture an active matrix type organic EL display body at low cost by pattern-applying organic light emitting materials of red, green and blue on a base having a thin film transistor by means of ink jet.

SOLUTION: On a glass base 101, an ITO transparent picture element electrode 103 is formed after a thin film transistor 102 is formed thereon. A positive hole injection layer 104 of polyphenylene vinylene or the like is further formed thereon. This positive hole injection layer 104 is obtained by applying polytetrahydrothiophenyl phenylene of precursor followed by heating and polymerization. Organic light emitting layers 106-108 of red, green and blue are formed thereon every picture element. The organic light emitting layers are color- arranged and formed according to the pattern of each color every picture element by an ink jet printer 105. Further, A reflecting electrode 109 such as Mg, Ag or the like is formed thereon by evaporation.



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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the manufacture method using the ink jet method of EL display object of the active-matrix mold which used the thin film transistor.
[0002]
[Description of the Prior Art] An organic EL device is an element made to emit light using emission (fluorescence and phosphorescence) of the light at the time of having the configuration whose thin film containing a fluorescence organic compound was pinched in cathode and an anode plate, making an exciton (exciton) generate by poured in and carrying out recombination of an electron and the electron hole (hole) to said thin film, and this exciton deactivating.
[0003] The feature of this organic EL device is 100 - 100000 cd/m2 at the low battery not more than 10V. It is that field luminescence of the high brightness of a degree is possible, and luminescence from blue to red is possible by choosing the class of fluorescent material.
[0004] The organic EL device attracts attention as what realizes a cheap large area full color display device (an Institute of Electronics, Information and Communication Engineers technical report, the 89th volume, NO.106, 49 pages, 1989). According to the report, the organic coloring matter which emits strong fluorescence was used for the luminous layer, and blue, green, and bright red luminescence have been obtained. this having emitted strong fluorescence by the shape of a thin film, and having used organic coloring matter with few pinhole defects -- it is -- high -- it is thought that the brightness full color display was realizable.
[0005] furthermore, the thin film layer to which the component of an organic luminous layer becomes JP,5-78655,A from the mixture of an organic charge material and an organic luminescent material -- preparing -- concentration quenching -- preventing -- the selection width of face of luminescent material -- extending -- high -- the purport used as a brightness full color element is proposed.
[0006] However, reference is made by neither of the reports about the configuration and the manufacture method of an actual full color display panel.
[0007]
[Problem(s) to be Solved by the Invention] The organic thin film EL element using the above-mentioned organic coloring matter shows luminescence of blue, green, and red. However, in order to realize a full color display object as known well, it is necessary to arrange the organic luminous layer which emits light in the three primary colors for every pixel. Conventionally, technology which carries out patterning of the organic luminous layer was made very difficult. A cause is the point that the surface of metal of one of reflector material is unstable, and the patterning precision of vacuum evaporationo does not come out. The 2nd is the point that polymer or the precursor which form a hole-injection layer and an organic luminous layer do not have resistance to patterning production processes, such as photolithography.
[0008] This invention solves a technical problem which was mentioned above, and the purpose is in offering the manufacture method of the active-matrix mold EL display object which carried out patterning of the organic luminous layer for every pixel with the ink jet method.

[0009]
[Means for Solving the Problem] A manufacture method of an active-matrix mold organic electroluminescence display object in connection with this invention A hole-injection layer is formed in the transparence pixel electrode upper layer formed in a glass substrate which has a thin film transistor. In a manufacture method of an active-matrix mold organic electroluminescence display object that an organic luminous layer which has the luminescent color besides chosen as a layer from red, green, and blue for every pixel at least is formed, and a reflector is further formed in this upper layer It is characterized by making formation and an array of said organic luminous layer by ink jet method. In the transparence pixel electrode upper layer formed in a glass substrate which has a thin film transistor, for every pixel at least Moreover, red, In a manufacture method of an active-matrix mold organic electroluminescence display object that an organic luminous layer which has the luminescent color chosen from green and blue is formed, and a reflector is further formed in this upper layer, it is characterized by making formation and an array of said organic luminous layer by ink jet method.
[0010] In the reflective pixel electrode upper layer formed in a glass substrate which has a thin film transistor, for every pixel at least Furthermore, red, In a manufacture method of an active-matrix mold organic electroluminescence display object that an organic luminous layer which has the luminescent color chosen from green and blue is formed, a hole-injection layer is formed in this upper layer, and a transparent electrode is further formed in this upper layer It is characterized by making formation and an array of said organic luminous layer by ink jet method. In the reflective pixel electrode upper layer formed in a glass substrate which has a thin film transistor, for every pixel at least Moreover, red, In a manufacture method of an active-matrix mold organic electroluminescence display object that an organic luminous layer which has the luminescent color chosen from green and blue is formed, and a transparent electrode is further formed in this upper layer, it is characterized by making formation and an array of said organic luminous layer by ink jet method.
[0011] As shown in drawing 3 in short, on the signal line 301 formed on a substrate, the gate line 302, the pixel electrode 303, and a thin film transistor 304, by the ink jet method, this invention is carrying out patterning spreading of red and the organic green and blue luminescent material, and realizes a full color display.
[0012]
[Embodiment of the Invention] Hereafter, the suitable operation gestalt of this invention is explained with reference to a drawing.
[0013] (Example 1) As shown in drawing 1 , after forming a thin film transistor 102 on a glass substrate 101, the ITO transparence pixel electrode 103 is formed.
[0014] The polytetrahydro thiophenyl phenylene which is a polymer precursor as a hole-injection material is coated. By heating, a precursor serves as polyphenylene vinylene and the hole-injection layer 104 with a thickness of 0.05 microns is formed.
[0015] Next, patterning spreading of the luminescent material which colors red, green, and blue with the ink jet printing equipment 105 is carried out, and the coloring layers 106, 107, and 108 with a thickness of 0.05 microns are formed. Polyphenylene vinylene is used for cyano polyphenylene vinylene and green luminescent material, and polyphenylene vinylene and the poly alkyl phenylene are used for blue luminescent material at red luminescent material. It is the Cambridge Display Technologies make, and these organic electroluminescence materials are liquefied and available.
[0016] Finally, the MgAg reflector 109 with a thickness of 0.1-0.2 microns is formed with vacuum deposition.
[0017] Thereby, the full color organic electroluminescence display object of a direct viewing type is completed.
[0018] (Example 2) As shown in drawing 2 , after forming a thin film transistor 202 on a glass substrate 201, the AlLi reflective pixel electrode 203 is formed.
[0019] Next, patterning spreading of the luminescent material which colors red, green, and blue with the ink jet printing equipment 207 is carried out, and the coloring layers 204, 205, and 206 are formed. Polyphenylene vinylene is used for cyano polyphenylene vinylene and green luminescent material, and

polyphenylene vinylene and the poly alkyl phenylene are used for blue luminescent material at red luminescent material. It is the Cambridge Display Technologies make, and these organic electroluminescence materials are liquefied and available.
[0020] The polytetrahydro thiophenyl phenylene which is a polymer precursor as a hole-injection material is formed by the cast method. By heating, a precursor serves as polyphenylene vinylene and the hole-injection layer 208 is formed.
[0021] Finally, the ITO transparent electrode 209 is formed with vacuum deposition.
[0022] Thereby, the full color organic electroluminescence display object of a reflective mold is completed.
[0023] (Example 3) as an organic luminescent material of an organic luminous layer -- 2, 3, 6, 7-tetrahydro-11-oxo--1H, and 5H and 11H -- it considers as a green luminescent material by mixing both using a -(1) benzo PIRANO [6, 7, 8-ij]-kino lysine-10-carboxylic acid, using a 1 and 1-screw-(4-N and N-ditolylamino phenyl) cyclohexane as an organic hole-injection layer material.
[0024] Similarly, they are 2-13' and 4'-dihydroxy phenyl as an organic red luminescent material. - It mixes with a hole-injection layer material using 3, 5, and 7-trihydroxy-1-benzo pyrylium perchlorate.
[0025] Furthermore, tris (8-hydroxy quinolinol) aluminum is used for a blue luminous layer as an organic hole-injection material, and it is 2, 3, 6, and 7-tetrahydro-9-methyl-11-oxo-as an organic luminescent material. - A 1H, 5H, and 11H-(1) benzo PIRANO [6, 7, 8-ij]-kino lysine is mixed, and luminescent material is created.
[0026] At the same production process as an example 1 or an example 2, partial patterning of each luminous layer is carried out with ink jet printer equipment, and an active-matrix mold organic electroluminescence display object is created.
[0027] Besides the organic electroluminescence material used by this example, in addition, an aroma tick diamine derivative (TDP), An oxy-diazole dimer (OXD), an oxy-diazole derivative (PBD), A JISUCHIRU arylene derivative (DSA), a quinolinol system metal complex, a beryllium-benzo quinolinol complex (Bebq), A triphenylamine derivative (MTDATA), a JISUCHIRIRU derivative, a pyrazoline dimer, Although rubrene, Quinacridone, a triazole derivative, polyphenylene, the poly alkyl fluorene, the poly alkyl thiophene, an azomethine zinc complex, the Pori Phi Lynne zinc complex, a benzo oxazole zinc complex, and a phenanthroline europium complex can be used It is not the object restricted to this.
[0028]
[Effect of the Invention] Patterning became possible in forming and arranging the organic electroluminescence material it was presupposed that patterning was impossible of a material conventionally with an ink jet method, and the active-matrix mold organic electroluminescence display object of a full color display was realized. Manufacture of the full color display object of a big screen is attained [that it is cheap and] by this, and an effect is size.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the production process of the active-matrix mold organic electroluminescence display object in the 1st operation gestalt of this invention.
[Drawing 2] It is drawing showing the production process of the active-matrix mold organic electroluminescence display object in the 2nd operation gestalt of this invention.
[Drawing 3] It is drawing showing the coloring layer formed by the ink jet method on the thin film transistor of this invention.
[Description of Notations]
101 Glass Substrate
102 Thin Film Transistor
103 Transparence Pixel Electrode
104 Hole-Injection Layer
105 Ink Jet Printer Arm Head
106 Organic Luminous Layer (1st Color)
107 Organic Luminous Layer (2nd Color)
108 Organic Luminous Layer (3rd Color)
109 Reflector
201 Glass Substrate
202 Thin Film Transistor
203 Reflective Pixel Electrode
204 Organic Luminous Layer (1st Color)
205 Organic Luminous Layer (2nd Color)
206 Organic Luminous Layer (3rd Color)
207 Ink Jet Printer Arm Head
208 Hole-Injection Layer
209 Transparent Electrode
301 Signal Line
302 Gate Line
303 Pixel Electrode
304 Thin Film Transistor
305 Organic Luminous Layer (1st Color)
306 Organic Luminous Layer (2nd Color)
307 Organic Luminous Layer (3rd Color)

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CLAIMS

[Claim(s)]
[Claim 1] A hole-injection layer is formed in the transparence pixel electrode upper layer formed in a glass substrate which has a thin film transistor. In a manufacture method of an active-matrix mold organic electroluminescence display object that an organic luminous layer which has the luminescent color besides chosen as a layer from red, green, and blue for every pixel at least is formed, and a reflector is further formed in this upper layer A manufacture method of an active-matrix mold organic electroluminescence display object characterized by making formation and an array of said organic luminous layer by ink jet method.
[Claim 2] The manufacture method of the active-matrix mold organic-electroluminescence display object characterized by to make formation and an array of said organic luminous layer by ink-jet method in a manufacture method of an active-matrix mold organic-electroluminescence display object that an organic luminous layer which has the luminescent color chosen from red, green, and blue as the transparence pixel electrode upper layer formed in a glass substrate which has a thin film transistor for every pixel at least is formed, and a reflector is further formed in this upper layer.
[Claim 3] In the reflective pixel electrode upper layer formed in a glass substrate which has a thin film transistor, for every pixel at least Red, In a manufacture method of an active-matrix mold organic electroluminescence display object that an organic luminous layer which has the luminescent color chosen from green and blue is formed, a hole-injection layer is formed in this upper layer, and a transparent electrode is further formed in this upper layer A manufacture method of an active-matrix mold organic electroluminescence display object characterized by making formation and an array of said organic luminous layer by ink jet method.
[Claim 4] The manufacture method of the active-matrix mold organic-electroluminescence display object characterized by to be made formation and an array of said organic luminous layer by ink-jet method in a manufacture method of an active-matrix mold organic-electroluminescence display object that an organic luminous layer which has the luminescent color chosen from red, green, and blue as the reflective pixel electrode upper layer formed in a glass substrate which has a thin film transistor for every pixel at least is formed, and a transparent electrode is further formed in this upper layer.

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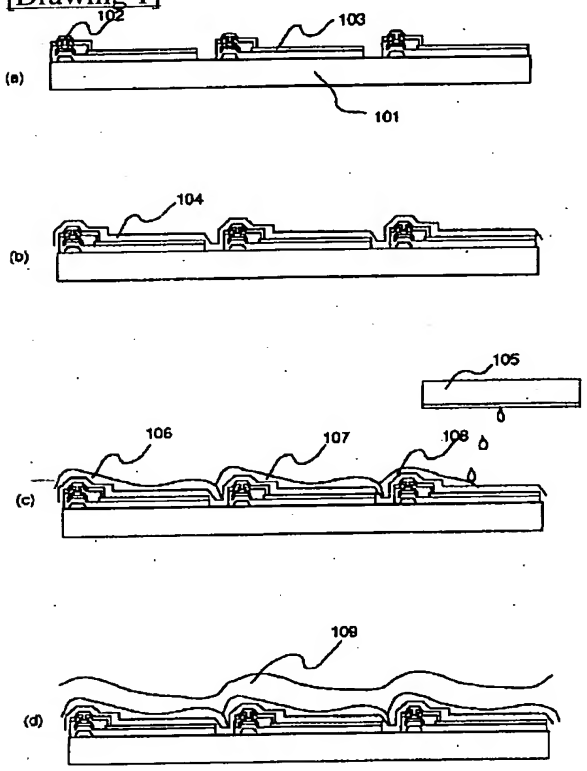
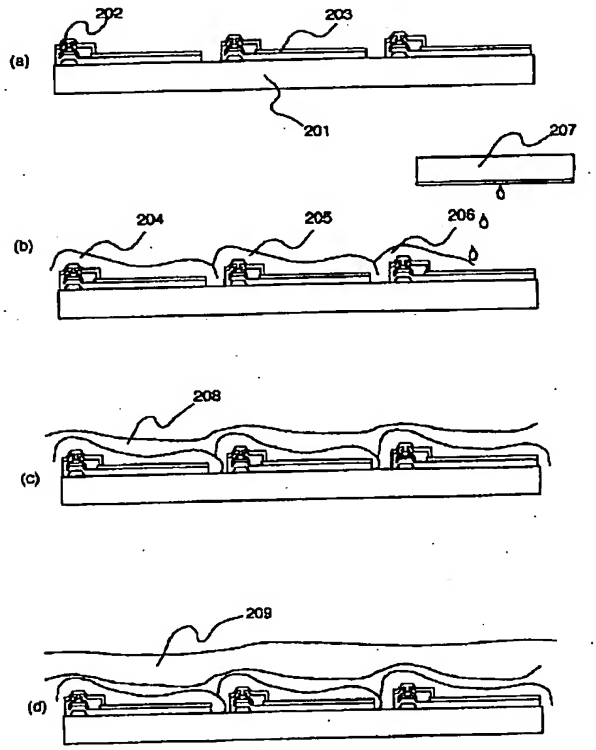
DRAWINGS

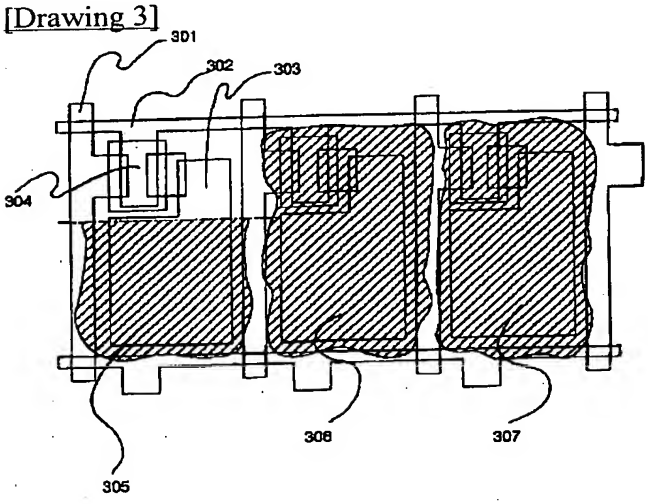
[Drawing 1]



[Drawing 2]



[Drawing 3]



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